A STUDY OF CONCENTRATE SPRAYS FOR THE CONTROL OF THE EUROPEAN CORN BORER

BY

JAMES WILBUR APPLE

B.S., Ohio State University, 1937
M.S., Iowa State College, 1940

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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Introduction

Batchelder and Questel (1945) published the first evaluation of a concentrate spray for the control of the corn borer, *Pyrausta nubilalis* (Hbn.). These authors used an oil solution containing 9 per cent DDT and applied it at a rate of 2.25 gallons to the acre. Four aerial applications of this spray resulted in 92.5 per cent control of the corn borer on sweet corn. Four aerial applications of DDT dust, which provided an equal amount of toxicant per acre, gave only 74.1 per cent control.

Decker et al. (1947) also reported good control of the corn borer on sweet corn by the application of concentrate sprays with aircraft. In one experiment, they used an oil spray containing 0.67 pound of DDT per gallon and applied it at the rate of 2.25 gallons per acre. Three applications of this spray gave better borer control than three applications of 5 per cent DDT dust applied at 40 pounds to the acre. In another experiment, they used an oil spray containing 0.5 pound of DDT to the gallon. Four applications of this spray at a rate of 1.6 gallons to the acre gave better results than four applications of DDT dust, which provided 1.25 pounds of DDT to the acre during each application. The spray also gave better borer control than four applications of 40 per cent *Ryania* and 1 per cent rotenone dusts each applied at the rate of 40 pounds to the acre.

Bigger et al. (1947) used an oil spray containing 0.5 pound of DDT to the gallon in a corn borer control experiment on dent corn. The spray was applied by plane at the rate of 2 gallons to the acre. Three applications of spray gave better corn borer control than three applications of 5 per cent DDT dust applied at 25 pounds to the acre. The authors reported a slight loss in yield from the use of the oil spray.

Recent development of ground operated concentrate sprayers has added impetus to the use of sprays at the rate of two to fifteen gallons per acre. Such equipment was used in the present study to evaluate various insecticidal formulations against the corn borer. Most comparisons were made at an application rate of three gallons of spray to the acre. Such an application simulates aerial applications and represents the lower dosage rates feasible with ground equipment designed to apply a moderately coarse spray.

Experimental

Concentrate sprays were applied with two types of sprayers during 1947 in an attempt to control a heavy infestation of second generation corn borers in sweet corn. A 10-row Friend hydraulic-pneumatic sprayer was used in one experiment to make applications of 2.5, 3, and 4 gallons of spray to the acre by the use of low liquid and air pressure. The spray produced by this machine was composed of droplets averaging about 40 microns in diameter. The second experiment was an evaluation of 12 concentrate sprays applied with a 4-row hydraulic sprayer equipped with two "Teejet 500050" fan nozzles to the row. The sprays were applied at a rate of 3 to 4 gallons to the acre with a spraying pressure of 35 pounds. The spray droplets from this type of nozzle averaged about 120 microns in diameter.

Two additional concentrate spray experiments were made in 1948 with the hydraulic sprayer. The first of these experiments was an evaluation of 23 insecticidal sprays applied at the rate of 3 gallons to the acre for first generation corn borer control. Two "Teejet 650067" fan nozzles were used per row and spraying pressures varied from 28 to 34 pounds depending upon the composition of the spray. A conventional high pressure (200 lbs.) sprayer was used in this experiment to make a 50 gallon per acre application. A similar experiment was conducted in 1948 to evaluate 25 insecticidal sprays against second generation corn borers. In this test, the 3 to 5 gallon application rates were made with three "Teejet 1.27"

hollow cone nozzles to the row. Oil solutions and water emulsions were applied with pressures of 48 and 70 pounds, respectively.

The majority of spray formulations used in this study contained DDT as the toxicant. Concentrations of 0.2 and 0.33 pound of DDT to the gallon were made in oil without the use of a co-solvent. However, the greater number of DDT-oil solutions contained 0.5 pound of DDT to the gallon, and in such cases a co-solvent was necessary to maintain the solution. The co-solvents included Velsicol AR-60, Velsicol AR-50G, Sun solvent 3, Shell solvent E-407, Amsco 550, Sovacide 544-C, Indocene 90, Brown solvent 4, carbon tetrachloride, and cyclohexanone. The amount of solvent used in a formulation depended upon the solubility of DDT in the solvent. The six base oils used in this study were Shell horticultural oil 7, Superla 13, Sun 30747-B, mineral seal oil, Apco 700, and Blandol.

Other toxicants tested as oil solutions included DDD, toxaphene, parathion, heptachlor, compound 118, chlordan, and *Ryania* extractives. Parathion was the only one of these insecticides requiring a co-solvent to maintain the solution in oil.

Water emulsions of DDT were used during these experiments as a standard treatment, since concentrate sprays of this type have been used for several years to control the corn borer. *Ryania* extractives were used in water solution and as a water emulsion. Water emulsions containing rotenone-piperonyl butoxide and rotenone-pyrethrins-piperonyl butoxide also were employed in concentrate sprays.

Laboratory tests were made during the spring of 1948 to evaluate the phytotoxic properties of concentrate sprays. A technique was developed for spraying potted corn plants in order to provide a more critical analysis of plant injury than could be made under field conditions. A procedure for classifying necrotic and chlorotic injury on corn was established and used in these laboratory tests and subsequent field tests.

VITA

James Wilbur Apple was born September 3, 1915 in Ann Arbor, Michigan, the son of Wilbur Martin and Mable Hoolihan Apple. He attended grammar schools in Washington D.C. and Columbus, Ohio. In June, 1933, he graduated from North High School in Columbus. He enrolled in the College of Agriculture of Ohio State University in 1933 and graduated from that institution in June, 1937, receiving a Bachelor of Science degree in Agriculture. Graduate work in entomology was begun at Iowa State College in September, 1937. A Master of Science degree in Entomology was obtained from this college in March, 1940. He continued his graduate work at the University of Illinois beginning September, 1943.

His first employment in the field of entomology was as a laboratory assistant with the U. S. Bureau of Entomology and Plant Quarantine in Columbus, Ohio beginning in 1930. Part or full time was spent with this agency until 1937. He had subsequent appointments as an agent with this Bureau during the summers of 1938 and 1940. He held a teaching fellowship at Iowa State College from September, 1937, to March, 1938 and from September, 1939 until June, 1940. During the year from September, 1938 until September, 1939, he held an exchange instructorship in the Department of Entomology at Oklahoma A. and M. College. He was an instructor in the Department of Zoology and Entomology at Iowa State College from September, 1940 until March, 1942. He took a position as Northern Field Entomologist with the Illinois Natural History Survey in March, 1942. He has continued with this agency as a Field Entomologist and Associate Entomologist up to the present time except for a six months leave of absence, extending from August, 1945 until February, 1946, for duty in the armed services.

He was married to Madeline Lucille Mason in Colum-

bus, Ohio, September 3, 1938. Their daughters, Suzanne and Judith, are nine and six years old, respectively.

He is a member of Sigma Xi, Gamma Sigma Delta, and Phi Sigma. He has been a member of the American Association of Economic Entomologists since 1937. During 1947 and 1948, he served as Secretary-Treasurer of the North Central Branch of the American Association of Economic Entomologists.

PUBLICATIONS

Apple, J. W. (1941) The influence of sodium and calcium chlorides on toxicity of nicotine to eggs of *Musca domestica* L., J. Econ. Ent., 34 (1) : 84-85.

Howard, Neale F., and J. W. Apple (1943) Toxicity of cube vegetable oil dusts to two species of aphids, J. Econ. Ent., 36 (1) : 59-62.

Apple, J. W., and Charles H. Richardson (1944) Comparative toxicities of copper hydroarsenate and copper hydroarsenate-arsenite mixtures, J. Econ. Ent., 37 (5) : 666-671.

Apple, J. W. (1945) DDT to control cabbage caterpillars, J. Econ. Ent., 38 (3) : 410.

Apple, J. W. and Charles Y. Arnold (1945) The use of tuber specific gravity in determining the effectiveness of leafhopper insecticides, Am. Pot. Jour., 22 (11) : 339-343.

Decker, G. C., J. W. Apple, J. M. Wright, and H. B. Petty (1947) European corn borer control on canning corn, J. Econ. Ent., 40 (3) : 395-400.

Linn, M. B., J. W. Apple, and C. Y. Arnold (1948) Leafhopper control with DDT in relation to the length of season, quality and yield of 17 potato varieties, Am. Pot. Jour., 25 (9) : 315-328.

Apple, J. W., G. C. Decker (1949) Insecticidal dust formulations for corn borer control, J. Econ. Ent., 42 (1) : 88-92.

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